

Applied Art (Modelling, Designing, Enamelling, Repousse work, Wood Carving, &c.).

As the teaching would be specially directed to the industrial applications of science it is needless to say that considerable subdivision would be required in the subjects named. . . .

. . . It is of great importance that the professors should be not only teachers, but investigators, constantly endeavouring to enlarge the field of accurate knowledge, and scientific procedure, in our industries. To appreciate how much may be effected in this way we have only to consider the millions saved to France by Pasteur's researches on the disease of the silkworm, or the knowledge obtained by his inquiry on fermentation.

. . . The time of the professors may be much economised by making it no part of their duty to commence their courses with the elements of general science. It is quite unnecessary that they should do so. This teaching may be obtained at other places, with which the Industrial University would be only needlessly interfering if it gave elementary instruction. It should, on the contrary, be its object to supplement and specialise the knowledge obtainable in ordinary science classes from which the students should be drawn; and they should be expected to have acquired sufficient general knowledge of science before entering the classes and laboratories of the University to be able to follow its courses with advantage.

A leading feature of the University should be evening courses—not merely popular lectures—for the use of those whose circumstances in life have rendered it necessary that they should commence the practical work of life early. By circumstances in life I do not refer solely to poverty. There are many occupations that it is advisable, if not necessary, to enter upon early. For instance, it is of the utmost importance for a mechanical engineer to be a good practical workman. To do this he must join the workshop when young. And the lad who enters when he is thirteen has an advantage which might not be expected. Mr. Phythian, the Master of the Oldham School of Science and Art established by the Messrs. Platt, informs me that to the lads who come into the workshop at this age the evening intellectual work is no effort; it is a relaxation and recreation. To the apprentices who enter at eighteen it is almost an impossibility. They are so exhausted by their day's labour that they cannot pay attention.

It is agreed on all hands that if the teaching of science is to be of any use it must be essentially practical—that is to say, the teaching of the laboratory. And no pains should be spared to make the laboratories perfect and readily available. By them the University may supply a great want.

It is perhaps necessary to guard against the idea that the University is to teach any trade or business. There could be no greater mistake than for it to attempt to do so. The purely technical knowledge of a trade must be learnt by practising it. The teaching of a public institution can with advantage only extend as far as the special application of various branches of abstract science to the different arts. It is no doubt difficult to define how far the teaching of applied science may go without trenching on the workshop. But in practice the limits are readily found. This difficulty will be still less felt in an institution drawing its pupils from among those actually engaged in trade, who will know what they can acquire in the University, and what they can better learn directly in business. The programme of examinations in technology by the Society of Arts will give many suggestions on this subject.

I have no doubt that the Society of Arts would be willing to transfer the whole or a part of their system of examinations in technology to such a body as the City Guilds, who, with far larger funds at their disposal, may give it a development which the Society of Arts can never obtain for it. By employing local agencies and taking advantage of the machinery of the Science and Art Department, these examinations are held throughout the country. And by availing itself of this and similar organisations, the Central University might be brought *en rapport* with every part of England, Scotland, and Ireland.

. . . Through the action of the Government, stimulating local effort, the country is being rapidly covered by a network of Science and Art schools and classes, where the working classes—whose interests and advances the City Guilds are, I understand, especially anxious to promote by the Industrial University—have opportunities of obtaining that elementary instruction in Science and in Art which must be the basis of any sound technical education. There are now 1,750 separate schools or classes in the country in connection with and receiving aid through the Science and Art Department.

It is therefore unnecessary to consider the question of the creation of any organisation for giving instruction in elementary general science or art. What are wanted are a stimulus to increase the number of students, the development of systematic courses of instruction onwards and upwards from the elementary school, and means to enable poor, but clever and industrious, youths to pursue such courses. The award of small scholarships or bursaries in competition which would support the holders while carrying forward their studies in a higher school—the retention of the bursary being contingent on a definite course of instruction being pursued satisfactorily—is therefore, I believe, the most effective means the Guilds can adopt to aid technical instruction.

. . . It is very necessary to bear clearly in mind in what directions the University must look for its pupils. Broadly speaking, these will I believe be:—

1. The holders of Bursaries and Scholarships.

2. Young men whose means enable them to carry on their education beyond the school age, and who can attend an institution in London more conveniently than elsewhere.

3. A limited number of students of the same class who are attracted by the goodness of the instruction and its appropriateness to their future pursuits. I say a limited number, because, however good the instruction, it will take years to divert the class of students from the channels which time has consecrated.

4. Evening students—men who are engaged during the day.

It would be useless to expect many students from classes 2 and 3 at first. . . .

The real point seems to me to make a beginning. Get a good site—by a good site I mean a site in an accessible position, sufficiently large to allow of expansion as the University grows—build chemical and physical laboratories, and lecture rooms, and some mathematical class rooms, on a portion of the site. If these are well managed, and are in a prominent position, such as that suggested on the Embankment, where they cannot but be seen—it is difficult to make anything known in London—surely there must be many rich men in the city besides the city companies who will seize the opportunity, by adding to the endowment or the buildings, of perpetuating their memories as munificent patrons of what will eventually be a credit to the country.

. . . It always seems to be forgotten that the population of London is as large as that of Scotland; and that if its provision for instruction were tenfold what it is, it would not be proportionately larger than that of the Canton of Zurich.

Any plan you commence upon must be much modified as the institution is expanded and developed. To succeed, the University must be built up by slow degrees and adapted, with the experience you gain from day to day, to meet the wants and circumstances of the time. That it will be a success, and a great success, if taken heartily in hand by the City of London, there can be no doubt.

Believe me,
Yours very faithfully,
J. F. D. DONNELLY

OUR ASTRONOMICAL COLUMN

THE OPPOSITION OF MARS IN 1892.—Early in August, 1892, the planet Mars will come into opposition at a distance sensibly the same as in September of the present year, when it is proposed to make a serious attempt to determine the solar parallax by observations of this planet, a method which has not hitherto been applied under such advantageous circumstances as are now possible, but which is calculated to furnish the sun's distance from the earth with a degree of precision comparable with that to be attained by the observation of a transit of Venus, and with far less trouble and expense. It will not perhaps be without interest at the present moment, when the attention of astronomers is particularly directed to the efficient observation of Mars near the opposition in September next, if we present an ephemeris for the opposition of 1892, the only one of the present century yet to come, which can be to all intents and purposes as favourable as that of 1877. The ephemeris is founded upon the tables of M. Leverrier, which have been applied with sufficient accuracy for the object in view. The positions are for mean noon at Paris.

1872	App. R.A. of Mars.	App. Decl. of Mars.	Log. distance from Earth.
July 23 ...	21 18 47.4	— 22 25 24	9.50247
„ 25 ...	— 17 5.9	22 38 27	9.58837
„ 27 ...	— 15 16.0	22 51 22	9.58489
„ 29 ...	— 13 19.0	23 4 0	9.58201
„ 31 ...	— 11 16.4	23 16 13	9.57975
Aug. 2 ...	— 9 9.3	23 27 51	9.57812
„ 4 ...	— 6 59.4	23 38 47	9.57714
„ 6 ...	— 4 48.1	23 48 55	9.57678
„ 8 ...	— 2 36.8	23 58 7	9.57705
„ 10 ...	21 0 27.1	24 6 18	9.57796
„ 12 ...	20 58 20.4	24 13 23	9.57951
„ 14 ...	— 56 18.0	24 19 18	9.58166
„ 16 ...	20 54 21.4	— 24 23 59	9.58443

The opposition will take place on August 4, and Mars will be in perigee on August 6 at a distance of 0.3774. The distance in perigee in the present year will be 0.3767.

THE COMET 1873 II. (TEMPEL, JULY 3).—This very interesting comet of short period will return to perihelion in 1878. The elements which rest upon the widest extent of observation are those of Mr. W. E. Plummer; in his orbit the period of revolution is 1850.25 days, or 5.066 years, and the perihelion passage in 1873 having taken place June 25.38, G.M.T., the comet, neglecting the effect of perturbations which in the present revolution is not likely to be material, will be again due in perihelion about 1878, July 19.5. Probably geocentric places derived from Mr. Plummer's orbit, with this date for perihelion passage, will give a sufficient idea of the circumstances of the next appearance, and a few positions so derived are accordingly subjoined:—

At 12h.	R.A.	N.P.D.	Distance from earth.
June 29 ...	322.5	97.4	0.437
July 9 ...	328.7	100.7	0.400
„ 19 ...	334.7	104.9	0.377
„ 29 ...	340.0	109.8	0.369
Aug. 8 ...	344.3	114.6	0.375
„ 18 ...	347.4	118.8	0.397

The comet, therefore, appears under conditions nearly as favourable as possible for observations, the least distance of its orbit from that of the earth being 0.33, at a greater radius-vector. In aphelion the comet is distant from the sun 4.555, and its distance from the orbit of the planet Jupiter at this point (which is that of nearest approach) is 0.736. Four days after perihelion passage the comet approaches the orbit of Mars within 0.05, all these distances being expressed in parts of the earth's mean distance from the sun.

There does not appear to have been any observation of this comet previous to 1873, notwithstanding its short period. It could neither have been the object seen on one morning only in October 1846 by Hind, nor that observed by Goldschmidt on May 16, 1855, which was at first mistaken for the short-period comet of De Vico (1844 I).

In addition to the comet in question, Tempel is also the discoverer of comet 1866 I, associated with the great November meteor-shower, and comet 1867 II, which was re-observed in 1873, after its orbit had undergone considerable change from a near encounter with Jupiter about the preceding aphelion passage.

NEW COMET.—Prof. Winnecke, the director of the Imperial Observatory at Strasburg, announces his discovery of “a fine bright comet, with nucleus and trace of a tail,” early on the morning of April 6. The following position depends upon observations with an annular micrometer on a $3\frac{1}{2}$ feet-telescope, the comet being inconveniently situated for the larger instrument.

April 5 at 15h. 53m. 39s. mean time at Strasburg, Right Ascension 22h. 7m. 49.44s., Declination + 14° 54' 15.4". The diurnal motion in R.A. is rather less than 1m., and that in Decl. about 14", both increasing.

The dearth of comets which had prevailed since December 1874, appears to have terminated, and we must soon hear of the

re-discovery of the one which bears the name of D'Arrest, and has been so elaborately calculated by M. Leveau.

[Since the above was in type the following elements, calculated by Herr Hartwig, have been received from Prof. Winnecke:—Perihelion passage, April 18.1741, Berlin time, longitude of perihelion, 251° 59' 57"; ascending node, 317° 51' 18"; inclination, 56° 42' 42"; logarithm of perihelion distance, 9.96767, motion retrograde. By these elements the comet at midnight on April 25, in R.A. 22h. 39m. and N.P.D. 42° 7', will have twice the theoretical intensity of light that it had on the date of discovery.]

CHEMICAL NOTES

THE NEW METALS ILMENIUM AND NEPTUNIUM.—About thirty years ago R. Hermann announced the discovery of a new metal, ilmenium, accompanying tantalum and niobium in various minerals, and closely allied to them in its general characters. Several years later he relinquished his claims to the discovery, in consequence of researches by Marignac in the same field leading to entirely different results. Later investigations have, however, strengthened his belief in the existence of ilmenium, and in the February number of Kolbe's *Journal für praktische Chemie* he not only brings forward results tending to establish the individual character of ilmenium, but describes a new metal, neptunium, belonging to the same group, and occurring in tantalite from Haddam, Connecticut. As the quantities obtained are small, the characteristic reactions limited, and as the spectral properties cannot be made use of, chemists will naturally reserve their opinion till confirmatory observations have been made by some other well-known investigator. The following are the essential results obtained by Hermann. The mineral was found to consist of equal portions of columbite (ROMe_2O_3) and ferroilmenite (RO_2MeO_2). By fusion with potassium bisulphate the hydrates of the metallic oxides were separated out in the following proportions:—

Ta_2O_3	...	...	...	...	32.39
Nb_2O_5	...	...	...	...	36.79
U_4O_7	...	...	...	...	24.52
Np_4O_7	...	...	...	...	6.30

100.00

The hydrates can be changed into double fluorides, and from the greater solubility of potassium-neptunium fluoride, it may be obtained free from tantalum and ilmenium salts but retaining a small quantity of the niobium salt; these, however, on being changed into niobate and neptunate of sodium may be separated on account of the greater solubility of the latter. By fusion of the neptunate of sodium with potassium bisulphate and treatment with water, the hydrate of neptunic acid was obtained in a pure condition. Neptunium may be distinguished from niobium and ilmenium by its having, along with tantalum, the property of forming an amorphous insoluble precipitate on the addition of caustic soda to the boiling solution of the fluoride; the other two form crystalline and easily soluble compounds. The very soluble character of neptunium-potassium fluoride as compared with the corresponding tantalum salt serves to distinguish it from that metal. The reactions with phosphorus salts in the inner part of the bunsen flame are the following:—tantalalic acid, colourless; niobic acid, blue; ilmenic acid, brown; neptunic acid, wine yellow. Addition of tincture of galls to solutions of the sodium salts gives characteristically coloured precipitates. The atomic weight of neptunium, determined from the double salt $4\text{KFl} + \text{Np}_2\text{Fl}_7 \cdot 2\text{H}_2\text{O}$, was found to be 118. Hermann has also obtained ilmenium in the form of a black powder by heating potassium-ilmenium fluoride with potassium chloride and potassium.

ABSORPTION OF HYDROGEN BY ORGANIC SUBSTANCES UNDER THE INFLUENCE OF THE SILENT DISCHARGE.—M. Berthelot has recently found that under the effect of the dis-